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ABSTRACT

This paper explores the role of vision in reading and studying. "How Vision Occurs" discusses the functions of rods, cones, the cerebral cortex, and the receptor senses. "The Optometrist and the Educator" views the role of the optometrist in relation to student learning. "Eye Anatomy Terms" defines the ciliary muscle, optic disc and nerve, macula and fovea, and external eye muscles. "Physiology of Vision While Studying" presents an account of the physiological phenomenon that occurs when a student studies. "The Under-Achiever" emphasizes that a student-oriented type of clinical optometric vision examination be given routinely to every underachiever once a year. "Observable Clues to Classroom Problems: A Check List" details a list of observable systems indicative of visual problems such as the appearance of the eyes, complaints during seat work, eye-hand coordination, visual form perception, and refractive status. (WR)

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THE PRACTICAL ASPECTS OF

THE VISUAL ACT IN STUDYING

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Sight is our most dominant sense. If it is not the dominant sense or the leader of the other senses, a reading problem is often the result. We live primarily in a visual world.

How Vision Occurs

The receptors of the eye are in the retina and are called rods and cones. The cones are for day vision, color and fine detail. The rods are for night vision and gross side objects and movement. The cones predominate centrally and the rods peripherally. The retina covers the interior back surface of the back part of the eyeball.

The rods and cones turn light energy (as from print of a book) into nerve excitation. These nerve impulses are carried to the highest part of the brain, the cerebral cortex, by the two optic nerves. These visual sensations are received by areas called 17 and 18 in the occipital lobes of the cortex which is at the back end of the head.

Perception of vision occurs when the visual cerebral sensations are integrated with the sensations of the other cerebral sensory receptors of the body.

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This integration occurs by way of association nerve fibers in the brain and brain-stem. The receptor senses that are most important for this integration are visual, hearing, tactual and proprioceptive. The speech centers of the brain and feed-back sensations from motor activity also become involved. This total involvement of all the senses, with vision dominating, might be called the concepualization of perception. The result is intelligence.

The Optometrist and the Educator.

Professionally, many areas of common interest motivate both the educator and the Optometrist. Within recent years a new ground of common concern has emerged. This is the area of the Psycho-physiological aspects of vision as they affect learning and reading. (2)

The traditional optometrist, accustomed to the milieu of a professional office, has had to orient himself to the wider area of helping students to read more clearly, efficiently, comfortably, and to better understand what they read.

In addition to concentrating on typical vision problems, the optometrist has broadened his field of service to include the problems of the retarded child, the poor achiever, and the slow reader.

Eye Anatomy Terms

Ciliary muscle. The ciliary muscle is also known as the muscle of accommodation. The ciliary muscle, by it's own natural tonus, has a pulling effect on the ligaments holding the lens. When the eyes are turned inward (converged) by the external muscles of the eyeball (as in reading print in a book), the ciliary muscle atuomatically

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pushes forward and releases the tautness of the suspensory ligaments from the lens.

The lens then, by it's own elasticity, becomes wider in it's fluid-like center. This results in a lens with greater magnifying power. The lens thus bends the light from the print of a book to a sharpened ~~print~~ point on the fovea of the retina at the back of the eye. This act is called accommodation.

Optic disc and nerve. The optic nerve connects the light receptor, or retina, with the brain. It consists of many nerves bound together by three sheaths which are continuous with sheaths of the brain. The optic disc is the area where the optic nerves exit from the eye. This area leaves an oval blind spot in the field of vision in each eye which is filled-in by the opposite eye.

Macula and fovea. The macula is at the back of the eye near the center point of the retina. It is the size of a dime. The macula is for our general vision such as driving, looking at a classroom or viewing television. This is where the cone cells predominate. The fovea centralis is the center of the macula and is rod free. It is as small as the end of an eraser of a standard pencil. This is the only place in the eye where clear fine vision can occur such as is required to see the print of a book.

The small area around the macula is called the perimacular area. The target, that each eye is looking at, must be placed within the perimacular area of each eye before binocular vision and fusion of the two visual fields can occur. If this does not happen, an individual will see double or suppress one image. This can result in one eye not seeing the target clearly.

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If this occurs in an eye of a young child, while the vision cells are developing, the blurriness can result in uncorrectable subnormal vision. This is called Amblyopia. Intermittent suppression can be a cause for confusion while reading, and could result in poor school achievement.

External eye muscles. There are three pairs of outer eye muscles for each eye. These control the movements of the eyes. They help each eye to line up correctly so that the object being looked at is on a straight line from object to fovea centralis at the back of the eye.

Physiology of Vision While Studying

The following is an account of the physiological phenomenon that occurs when a student studies. An amount equivalent to about fifteen units of nerve energy is needed to make the outer or external eye muscles converge the eyeballs inward and see the word singly. Two and one-half units of nerve energy are needed to make the internal ciliary muscles of each eye focus the lens so that the lens accommodates on a word at 16 inches and the student sees the word clearly. These two functions must occur together and reflexly as one mechanism. This is the visual act that occurs while studying. The optometrist measures this binocular accommodative-convergence ratio clinically. If the convergence is found deficient then the student is using too much energy to keep the word from becoming double while studying. This kind of visual dysfunction is called convergence fatigue. The student will feel headachy or

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experience a "pulling" sensation between the eyes and he tires easily. He will lose his place easily while reading. If the words run together or tney are hard to focus while studying, then the student will have to use more than the normal amount of nerve energy to keep the letters clear. This dysfunction is called accommodative deficiency or fatigue. He will "not feel like reading" because a visual and mental fatigue occurs that gets worse the longer he tries to look at the book. (2) He reports that he can only read a short time comfortably. He naturally becomes bored. He cannot concentrate or keep his attention on his study assignment. He avoids desk work and often makes a nuisance of himself in class.

Juvenile delinquency can be a result of a lack of optometric care. A high correlation has been found for teen-age delinquents who are poor readers and who also have uncorrected accommodative near-point problems. (3) This accommodative insufficiency while studying can be corrected by spectacles and/or eye exercise. The lenses that keep this accommodative fatigue from occurring in it's early stages, and possibly prevent fatigue from occurring, are called achievement or study lenses. They are like exercise glasses. They are often needed for the student who is in the lower 1/3 of his class. Every student who is attending a community college learning center is a potential candidate for study classes. For such a student a vision survey is inadequate. He should be given a complete optometric near point clinical exam routinely before he starts his work at a learning center.

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The Under-Achiever

A complete clinical optometric work-up should be provided for every underachiever. This is not a suggestion, but a "must," because the student cannot tell another person that his eyes are the cause of his school troubles. The student cannot diagnose his own visual problems because he has nothing with which to compare his visual anomaly. The poor achiever concludes that this is the way he is and nothing can be done about it. Moreover, there is no vision survey at school that can efficiently detect an accommodative or convergence near point fatigue problem. Testing eyes on Snellen's chart twenty feet away will not discover this near point problem. Clinical equipment in the office allows for special distance and near point tests. These tests, through a visual analysis with visual-motor perceptual tests, offer a syndrome which is needed to discover and correct a near point or vision reading anomaly problem.

It is both appropriate and mandatory that a student-oriented type of clinical optometric vision examination be given routinely to every under-achiever once a year.

Observable Clues to Classroom Vision Problems A check list (1)

The most obvious signs for an accommodative act deficiency is the student's avoidance of as much desk activity and studying as he can manage.

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1. APPEARANCE OF EYES:

One eye turns in or out at any time

Reddened eyes or lids

Frequent styes on lids

Encrusted eyelids

2. COMPLAINTS WHEN USING EYES AT DESK:

Headaches in forehead or temples

Burning or itching after reading or desk work

Nausea or dizziness

Print blurs after reading a short time

3. BEHAVIORAL SIGNS OF VISUAL PROBLEMS: (Classified under headings of observable visual performance)

A. Eye Movement Abilities (Ocular Motility)

Head turns as reads across page

Repeatedly omits words

Rereads or skips lines unknowingly

Loses place often during reading

Displays short attention span in reading or copying

Orients drawings poorly on page

B. Eye Teaming Abilities:

Complains of seeing double (diplopia)

Misaligns digits in number columns

Tilts head extremely while working at desk

Omits letters, numbers or phrases

Squints, closes or covers one eye

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C. Eye-Hand Coordination Abilities:

Must feel of things to assist in any interpretation required

Writes crookedly, poorly spaced: Cannot stay on ruled lines

Repeatedly confuses left-right directions

Uses his hand or fingers to keep his place on the page

D. Visual Form Perception (Visual Comparison, Visual Imagery, Visualization)

Fails to recognize same word in next sentence

Reverses letters and/or words in writing and copying

Confuses likeness and minor differences

Mistakes words with same or similar beginnings

Fails to visualize what is read either silently or orally

Whispers to self for reinforcement while reading silently

E. Refractive Status (Nearsightedness, Farsightedness, Focas Problems.)

Comprehension reduces as reading continued: loses interest too quickly

Holds book too closely; face too close to desk surface

Makes errors in copying from chalkboard to paper on desk

Fatigues easily; blinks to make chalkboard clear up after desk task and/or reading; not elsewhere

Avoids all possible near-centered tasks

Complains of discomfort in tasks that demand visual interpretation

Squints to see blackboard, or requests to move closer

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Rubs eyes during or after short periods of visual activity

It is important that the educator be knowledgable in this field of vision and learning. He must be especially aware as to the Observable Visual Clues given above. The educator is our first line of defense against a student becoming an under-achiever. But what about the college student who is still under-achieving? The educator must not only concern himself with the under-achieving student's scholastic remedial work, but also with seeing that this kind of student, when indicated, is referred for optometric remedial care. This might be his first step to being really able to achieve.

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